

AR21

Northern Telecom Limited

Annual Report
to Employees
1976



Northern Telecom Limited
1600 Dorchester Blvd. West
Montreal, Quebec H3H 1R1

Northern Telecom Limited

Northern Telecom Limited, formerly known as Northern Electric Company, Limited is the principal supplier of telecommunications equipment in Canada and the second largest in North America. It employs more than 25,000 people worldwide. The company operates 25 manufacturing plants in Canada, 12 in the United States and one each in Eire, Turkey, Brazil and Malaysia. A subsidiary, Nedco (1975) Limited, is the largest Canadian distributor of electrical and telecommunications products; another subsidiary, Bell-Northern Research Ltd., with seven laboratories in Canada and one in Palo Alto, Cal., is the largest industrial research organization in Canada.

Version française

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The cover

The cover design represents the transition for the company and its employees as we move from the analog era to the digital era in telecommunications. The wavy line symbolizes the analog sound wave being converted to a digital configuration by an encoder.

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The world's changing/ we must change with it

by Robert C. Scrivener

**Chairman of the Board and
Chief Executive Officer
Northern Telecom Limited**

Economically, this past year was a difficult one for nearly everybody. Most industrial nations are fighting the aftermath of the worst recession in 40 years, and governments around the world are still battling inflation and unemployment. The uncertainties made it a tough year for business as well. For many companies the weak economy meant poor sales. The best many could hope for was trying to keep up with the year before, which itself was a bad year.

For Northern Telecom, it was a difficult year, too, but a successful one despite the worldwide economic problems. For the fourth year in a row, we increased our sales and earnings. We continued to grow in our traditional markets in Canada and we penetrated new markets in other parts of the world. Our balance sheet is strong, and a healthy, financially strong company is the best job insurance we all have in these times of economic uncertainty.

This success doesn't belong to any one person, any one group or any one company. The credit for the company's success belongs to all of us — whether we worked in a lab, a factory, an office or drove a truck. Without the inventiveness needed to create new products, without the care and workmanship needed to produce high-quality telecommunications products, and without the innovative marketing skills needed to sell our products in one of the world's most competitive businesses, there would be no success story. Everyone's job is important and our success depends on every job being done well.

This past year marked a number of firsts for Northern Telecom; I am going to mention only a few. It was the first year for our new corporate name, Northern Telecom, which now gives us a distinctive identity throughout the world. It was the year in which we took the lead in a race to develop a full product line in the new digital technology which is revolutionizing the telecommunications industry. It was also my first year as your chairman and chief executive officer.

As many of you know, I have had a long association with Northern Telecom through Bell Canada, where I worked for 39 years. I have watched Northern Telecom grow from a company that had serious problems 10 years ago, to a company that is now internationally recognized as a leader in the telecommunications industry.

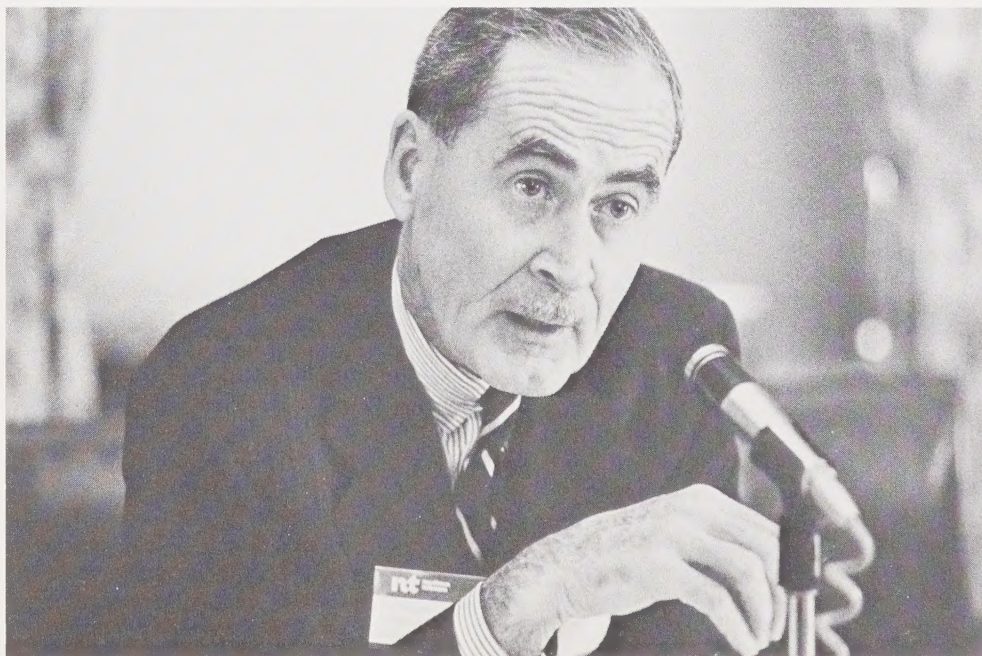
Only 10 years ago, we were primarily a local company manufacturing and supplying telecommunications products chiefly in Ontario and Quebec. Today, we supply telecommunications products right across Canada and in many other countries including the United States, which is by far the world's biggest and most competitive market and our second largest customer. We now have manufacturing facilities in nine of the 10 provinces, and in five other countries. In addition to being the largest manufacturer of telecommunications products in Canada, we are the second largest in North America — with 12 plants in the U.S. — and rank among the top five worldwide.

All told, we sell our products in nearly 40 different countries. More importantly, when we now speak about selling *our* products, we really mean *our* products. In 1971, only 17 percent of the products we manufactured and sold were designed and developed by Northern Telecom. In 1976, over 72 percent of our manufacturing sales were made up of Northern Telecom products. Five years from now that figure will be even higher.

At the beginning of the 1970s, Northern Telecom was a wholly-owned subsidiary of Bell Canada. Today, our company is publicly-owned. Its shares are traded on major stock exchanges in Canada and on the New York Stock Exchange in the United States.

The telecommunications business is a growth business; some expect it to grow as fast in the next two decades as the computer business did in the last two. The demand for telecommunications services and equipment has been, and still is, growing at a faster rate than the growth rate of national economies. This means there should be plenty of work for telecommunications companies in the years ahead.

But the opportunities will not become ours automatically. We will have to continue to fight hard for our share of the market. There are many other companies, big and small, which would like to take away our business. Domestically and internationally we are competing with some of the largest and strongest multinational companies in the world. Our future will depend on our



ability to continue to create, produce and market high-quality trend-setting products, better, faster, and at less cost than our competitors.

Much of our success will depend on our ability to adapt to change. Advances in telecommunications can be so rapid that a product may only have a life expectancy of a few years before it is obsolete. Keeping ahead of this change is the only way we can hope to hold on to the markets we already have and to gain new markets.

Many of us — me included — have had to adapt ourselves and learn new skills, new selling methods, and whole new jobs. We can expect to see more of this in the future. Surviving means leading and directing this change. It is a formidable challenge for all of us; but a challenge we will face with a very important advantage.

Our on-going and close association with Bell Canada and our jointly-owned research company Bell-Northern Research Ltd. keeps us in touch with every aspect of the telecommunications world. This tri-corporate structure is a rare, almost unique factor in the telecommunications industry. Our three closely associated, but separate, companies allow us all the benefits of total vertical integration from research and development to manufacturing to retail sales and service to telecommunications users. At the same time, our special relationship allows us to independently enter new markets and sell products and services to a much wider range of customers than would be possible under one corporate umbrella.

Bell Canada enjoys an international reputation as one of the best run and most modern telephone companies in the world. In addition to being Northern Telecom's largest customer for telecommunications equipment, Bell Canada is also a major source of information. Through Bell Canada we are in direct contact with the home owners, the businesses, the hospitals, and schools, and everyone else who use telephones or telecommunications services. We can respond quickly to new situations and new problems. We can supply our customers with a wide range of products which will give them maximum flexibility in meeting their own needs.

Bell-Northern Research is Canada's largest private research organization and one of the largest in North America. Despite Bell-Northern's youthful appearance — it was founded only five years ago and the

average age of its 1,950 employees is under 32 — it has already received the only kind of acclaim that really counts — market recognition. Worldwide sales of the Contempra telephone, the North America leadership of the SP-1 stored program switching system and the international reception of our new SL-1 electronic private automatic branch exchange attest to the technical superiority of products designed by Bell-Northern.

Bell-Northern's main laboratories are located in Montreal, Ottawa and Toronto, but a key element of our long-term strategy will be to locate other labs where they are needed. The first lab outside of Canada was established in Palo Alto, California in 1974. It develops new products and adapts our products for the very important U.S. market but just as important, it puts us in touch with some of the world's top scientists who work or teach in the area. We have been able to attract some of the finest minds in the business to work for Northern Telecom through our Palo Alto connection.



Effective long-term penetration of international markets will be critical to our future success. Canada will always be a main market. But we cannot survive in Canada alone. In order to raise the tremendous amounts of money needed to develop new products, to keep us competitive with the Japanese, American and West German telecommunications multinationals, we must market our products internationally.

The future of Northern Telecom and the future of all of our jobs will depend on how well we do this. We have had a record of success in the last few years. And looking ahead, there is every reason to believe we can continue this success in the future.

We currently are standing at the threshold of a very important change in the telecommunications world. The technology that made the most advanced computers possible is now being adapted to telecommunications.

The technology, called digital, means more efficient, reliable, and flexible telecommunications systems, providing a substantial cost savings for the telephone companies.

Digital systems mean better service for subscribers, whether in the home or office; more flexible private automatic branch exchanges for businesses; and increasingly efficient central office switching and long-distance transmission. In short, it will dramatically change the telecommunications business.

Last spring, we became the first telecommunications manufacturer to announce that we would provide a complete line of digital equipment by 1980. The new products we are introducing will include advanced central office switching systems like the DMS-10, DMS-100, and DMS-200, and a new digital microwave radio system called DRS-8. Our DMS-1 (digital carrier and remote switch) is currently undergoing field tests and will be introduced this year. These products will complement the digital products already introduced like the LD-4 digital transmission system and SL-1.

The economic ills the world has experienced in recent years will likely be with us for the next few years. But despite the problems, we can look forward to a healthy future if we are willing to put in the effort. Our success will depend on hard work from each of us. It will depend on our personal attention to details, producing the highest quality products and getting the job done on time.

But success will take more than just our individual efforts. It will take all of our efforts together. It will take cooperation and understanding at all levels, from the plant floor and sales offices right up to the managers and the senior executives. It is the kind of cooperation and spirit that has typified this company in the past. It is something we should all strive for in the future.

Where the money goes

Our customers bought \$1,112,009,000 worth of goods and services from us in 1976, a new record amount.

As in the past, the largest portion of these sales dollars went to our suppliers and to us as employees.

Out of every dollar we made, we paid out 40.2 cents, or a total of \$450 million, to other companies for materials, supplies and services necessary to make and sell our products and run our business on a day-to-day basis.

Our suppliers sold us everything from the raw materials, like copper and plastics, that go into our products to the punch presses and coil winding machines needed to make our products. They sold us the computers, the typewriters and pens, pencils and paper we needed to keep track of our inventories and supply our customers. We also spent part of the 40.2 cents for advertising and for the design concepts that went into our new name and new logo which now give us a uniform marketing image around the world.

You and I, as employees, received the next largest share of the income: 36.5 cents out of every sales dollar received by the company went to pay our salaries, wages and vacation pay. It also includes the company's contribution on behalf of the employees for workmen's compensation, pension funds, and hospital, medical and other plans the company supports. As employees, we earned \$406 million — a record level of wages and salaries and benefits.

Governments at all levels — federal, state, provincial and municipal — took a record level of taxes too. Our taxes amounted to \$159 million or 14.2 cents on each sales dollar received.

We received more in interest from our investments and cash in the bank than we paid out this year. Because our net interest showed a positive balance of more than \$2 million, or .2 cents, we have not included net interest as a slice of our dollar.

We also set aside \$24.6 million to allow for the wear-and-tear on our buildings, machinery and equipment.

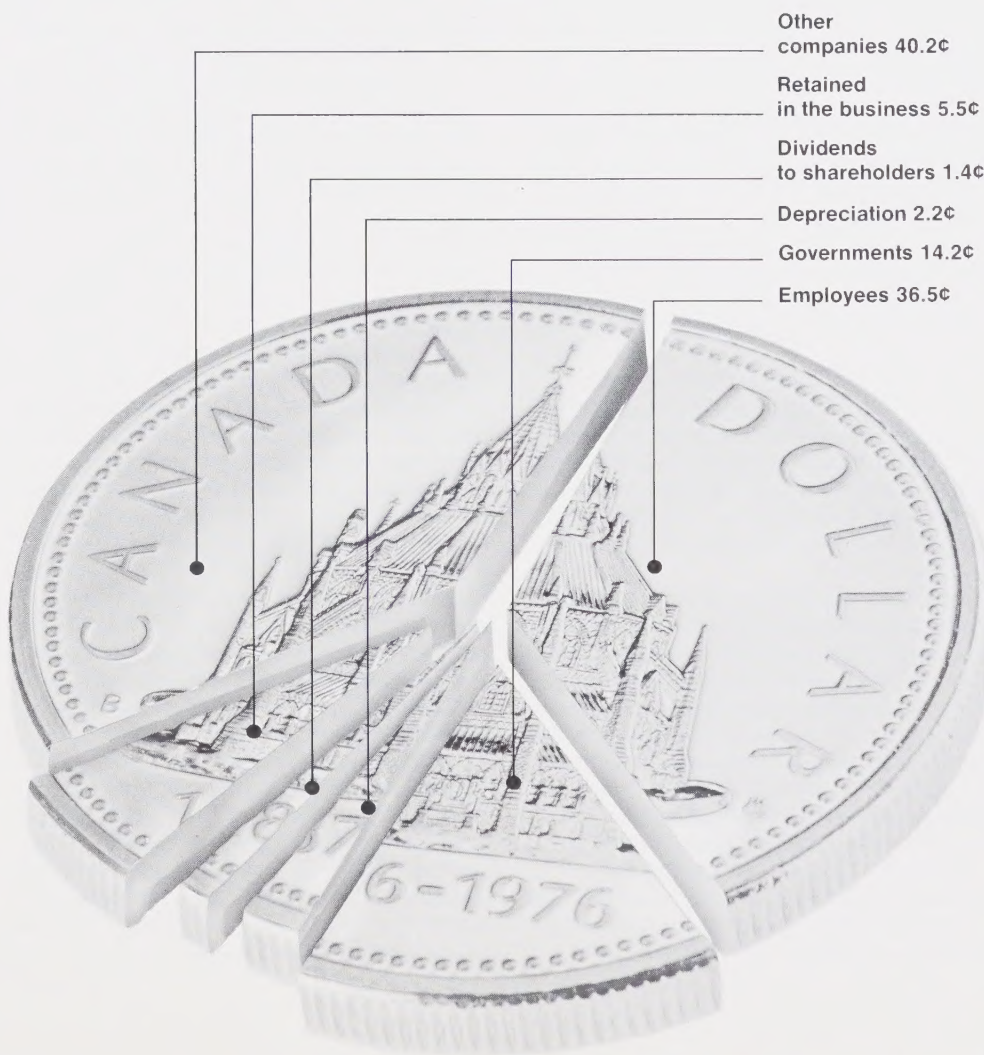
What was left, \$77.1 million or 6.9 cents of every sales dollar, was the company's earnings or profits. Out of these earnings we paid \$16 million in dividends to our shareholders. We retained nearly 80 per cent of our earnings, \$61 million, to reinvest in the business on new plant and equipment to help keep us competitive in the future.

How each sales dollar was spent

Other companies for materials, goods and services	40.2 cents
Employees, for wages, salaries and benefit plans	36.5 cents
Governments, to pay federal, provincial, state and municipal taxes	14.2 cents
Depreciation, to provide for wear-and-tear on plants	2.2 cents
Dividends to shareholders, for the use of their money	1.4 cents
Retained in the business for future needs	5.5 cents
	<hr/> 100.0 cents

How we spent a billion dollars

To other companies for materials, goods and services	\$447,980,000
To employees for wages, salaries and benefits	\$405,878,000
To governments for taxes	\$158,532,000
Depreciation, to provide for wear-and-tear on plants	\$ 24,579,000
Net interest on loans (surplus)	(\$ 2,059,000)
To shareholders as dividends, for use of their money	\$ 16,147,000
Retained in the business for future needs	\$ 60,952,000
	<hr/> \$1,112,009,000



Building our future on R&D

by Walter F. Light

**President
Northern Telecom Limited**

Last March, when reporting to you about the very successful year in 1975, I said that "one good year deserves another." I also said: "No one is going to give us another record year by default. We are going to have to earn it."

Well, we did. And it was.

Despite a stagnating economy at home and poor conditions in other countries of the world, 1976 was another good year for all of us at Northern Telecom. During 1976 we established some significant milestones for ourselves and for the industry.

Here are a few of the things we—you and I—accomplished in 1976:

- we set new record sales and earnings for the fourth year in a row
- we designed and built new products which were North American or world firsts and reinforced our technological leadership
- we cracked new markets in Europe and tackled new markets in other parts of the world
- we created new opportunities through new companies and entered new markets in the U.S. by acquisitions
- we became the first company to announce a new digital product line and we held the industry's first seminar on digital products for top telephone executives from around the world.

In 1976 we continued to lay foundations for future growth and future opportunity for all of us. We added new plants in Canada, we expanded plants and opened a new one in the United States and we expanded our plant in Turkey.

We also continued to spend record amounts of money on research and development to create the new products we will need in the future and to develop the complete line of digital switching and transmission products we have promised the industry we will have on the market by 1980.

Let's take a look at some of last year's successes and activities. Our worldwide sales rose to \$1.112 billion, up from \$1.018 billion in 1975. More than one third of those sales dollars, over 36 percent, or \$405 million went in paying you and me our wages and salaries and in providing for our pensions, insurance and other benefits. This amount was \$35 million higher than the \$370 million it took to pay us all in 1975.

Northern Telecom also earned more in 1976 than it did in 1975. After providing just over \$52 million for income taxes, we had earnings of just over \$77 million. Of this,

\$16 million, or just under 21 percent, was distributed in dividends to the shareholders for the use of their money and \$61 million was kept in the company to build new plants, buy new equipment and expand the business.

Corporate earnings are important to the company and to each of us. Strong earnings means we have the money with which to improve productivity through new plants, new equipment, new manufacturing processes and new products. These are the things that keep the company competitive and maintain our individual jobs.

Strong earnings are important too because they make us attractive to investors who provide us with money with which to expand the business. And, when we borrow money from banks, if we have a strong financial position with good earnings, we are able to get the best possible interest rate.

From an individual viewpoint, good company earnings are one of our best assurances of future jobs in good working conditions.

Our strong sales and earnings are the result of continued leadership in Canada, and in the U.S. independent telephone market, of our established products like the SP-1 electronic switching systems, made in Calgary, Alta., Brampton, Ont. and Creedmoor, N.C., and Pulse electronic private branch exchanges made in Belleville, Ont. and Mountain View, Cal. They are also the result of quick market acceptance of new products like the SL-1 digital business communications system, also being made at Belleville and Mountain View and the new computer-linked repair bureau dubbed CALRS (pronounced Callers), made at Brampton.

There are now more than one million lines, 94,000 trunks and 451 TOPS (traffic operation position system) positions being switched by our SP-1 electronic switching systems in Canada, the United States and Puerto Rico. Not bad for a product that was

introduced only five years ago. More importantly, we have orders or commitments for a further 662,600 lines and expect to obtain many more.

One of our big success stories last year was the SL-1, developed and put into production in Belleville. In less than a year it became one of the most sought after digital PABXs in North America and Europe. By its first anniversary we had delivered more than 100 systems in North America and sold two in Eire.

In Europe, two of the most prestigious telecommunications organizations, Televerket in Sweden and The General Electric Company of England chose SL-1 over all other competitive models and were sold licenses to manufacture and sell the SL-1 in their domestic markets.

I mentioned CALRS earlier. Its full name is Centralized Automated Loop Reporting System and it is the first fully-automated telephone repair service bureau in the world. The first one was put into service in Ottawa last October. Another seven are due to be installed by Bell Canada in Ontario and Quebec over the next three years.

CALRS uses the latest minicomputer technology to maintain trouble reports and circuit data, replacing old paper reports and providing instant recall. It will, on command, perform basic test programs and indicate "go" or "no-go" conditions; carry out automatic follow-up tests at regular intervals without supervision; carry out more complex individual tests; detect multiple faults due to a common cause; group trouble reports by geographic locations; suggest appointment times for repair visits; provide warnings of schedules in jeopardy and perform a variety of chores such as analysis of troubles and provision of status reports.

It's the imagination required to develop such "better mousetraps" as CALRS that will keep Northern Telecom in the forefront of telecommunications.

We also designed and developed a new electronic telephone set, which we have nicknamed the E-phone. The bulky mechanical components normally found in the base of the conventional telephone are replaced by integrated circuits in the E-phone. It creates a network so compact that it can be incorporated in the body of the handset. This makes it possible to significantly reduce the size of the handset or add extra circuitry that will give it a wide range of special capabilities.

Last May, we became the first company in the world to announce a full line of digital switching and transmission equipment to be available between 1977 and 1980. Without question the industry is going digital and a large part of all our futures is involved in digital equipment. This report contains a separate article on the digital era in telecommunications and our leading role in it. You will find it on page 6. I urge you to read it.



Dr. Allan A. Warrack (left), Alberta Minister of Utilities and Telephones and Walter F. Light talk about Alberta's increasing demand for telecommunications at the opening of the Western Canada Switching Plant in Calgary.

Strong new marketing approaches in Europe are beginning to bear fruit and our licensing agreements with Televerket and GEC of England are excellent examples of their success. We have been active in other world markets too. I led a special sales mission of senior executives to several countries in the Middle East where we are seeking business on a total-systems approach and a single-product approach. We are optimistic about our opportunities in that part of the world.

Other senior executives have been working in Latin America, particularly Vene-

zuela, where we have already sold Contempras and are now trying to sell central office switching and other major products.

Acquisitions in the United States, Cook Electric Company of Chicago and Telecommunication Systems of America, Inc. of Memphis, Tenn., will add significant strength to our drive to improve our share of the U.S. market. This is discussed in more detail by John Lobb on page 20.

We officially opened two new plants in Canada last year: a new switching products plant in St. John's, Newfoundland and an electronic switching systems plant in Calgary. New facilities for manufacturing cable were added to plants in Regina, Sask., and Amherst, N.S. Three small plants in Saint John and Moncton, N.B., were closed and the operations consolidated into a new plant in Saint John, N.B. Early this year, we announced our intention to open a small plant in Charlottetown, P.E.I., to manufacture telephone equipment fuses. When this plant opens we will have manufacturing facilities in nine of Canada's 10 provinces.

In the U.S., the subscriber switching plant at Mountain View expanded its manufacturing and office space by more than one-half with an addition of 32,000 square feet. The manufacturing space of the switching systems plant at Creedmoor was increased by 12,000 square feet. The Port Huron, Mich., station apparatus plant was closed and its operations moved to the new Nashville, Tenn., plant.

In Turkey, we increased the size of our plant by more than 70 percent, from 112,000 square feet to more than 200,000 square feet. This was really an expansion for both Turkey and Canada. The Turkish plant assembles much of its product from components made in Canada. The more the Turks are able to produce, the more components they will use and the more employment they create in Canadian plants.

Much of our success in 1976, and our success over the past five years, is the result of a high concentration of money and manpower to research and development. Over the past 10 years we have invested more than \$347 million in R&D. From this investment have come new products, annually higher sales, greater market penetration and jobs in Canada and new jobs and new enterprises in the United States, Eire and Malaysia.

As part of our dedication to R&D we formed, in association with Bell Canada, Bell-Northern Research. BNR today is Can-

ada's largest industrial research organization. Last year, again in association with Bell Canada, we formed another research organization, B-N Software Research Inc. With its headquarters in Toronto this new company will specialize in research and development in software technologies. Software is the name given to the computer programs which instruct, direct and control such equipment as the SL-1 business communications systems and the SP-1 switching systems.

The SP-1 is a good example of how our research dollars are converted into sales, earnings, taxes and jobs. We have spent to date more than \$80 million on R&D for the SP-1 product line. By December 1976, this research investment had produced:

- sales and orders worth more than \$700 million, or almost nine times the R&D investment
- 2,400 people employed in Canada today in the manufacture and marketing of the SP-1; a further 180 are employed making and selling SP-1 in the U.S.
- 150 people employed in Canada on continuing research on SP-1 and electronic switching systems
- 14.6 million hours of Canadian employment in manufacturing and 4 million hours of Canadian employment in R&D
- \$130 million paid to Canadians in wages and salaries in manufacturing and \$33 million paid to Canadians in salaries for R&D
- \$38 million paid to Canadian governments in sales taxes and \$34 million in corporate income taxes.

In addition there are several million hours of employment worked and several million dollars more in wages and salaries paid by outside supplier companies and in other Canadian Northern Telecom factories, which made over \$240 million worth of parts and components used in SP-1 assembly plants.

Our future success is bound up in R&D. What we did last year, the year before that, and the year before that will show up in products we turn out next year and the year after: advanced digital equipment, fiber optics, a monolithic digital line repeater, and a dry plasma etching process to produce smaller, more reliable, more efficient integrated circuits faster and at lower costs are just a few of these products.

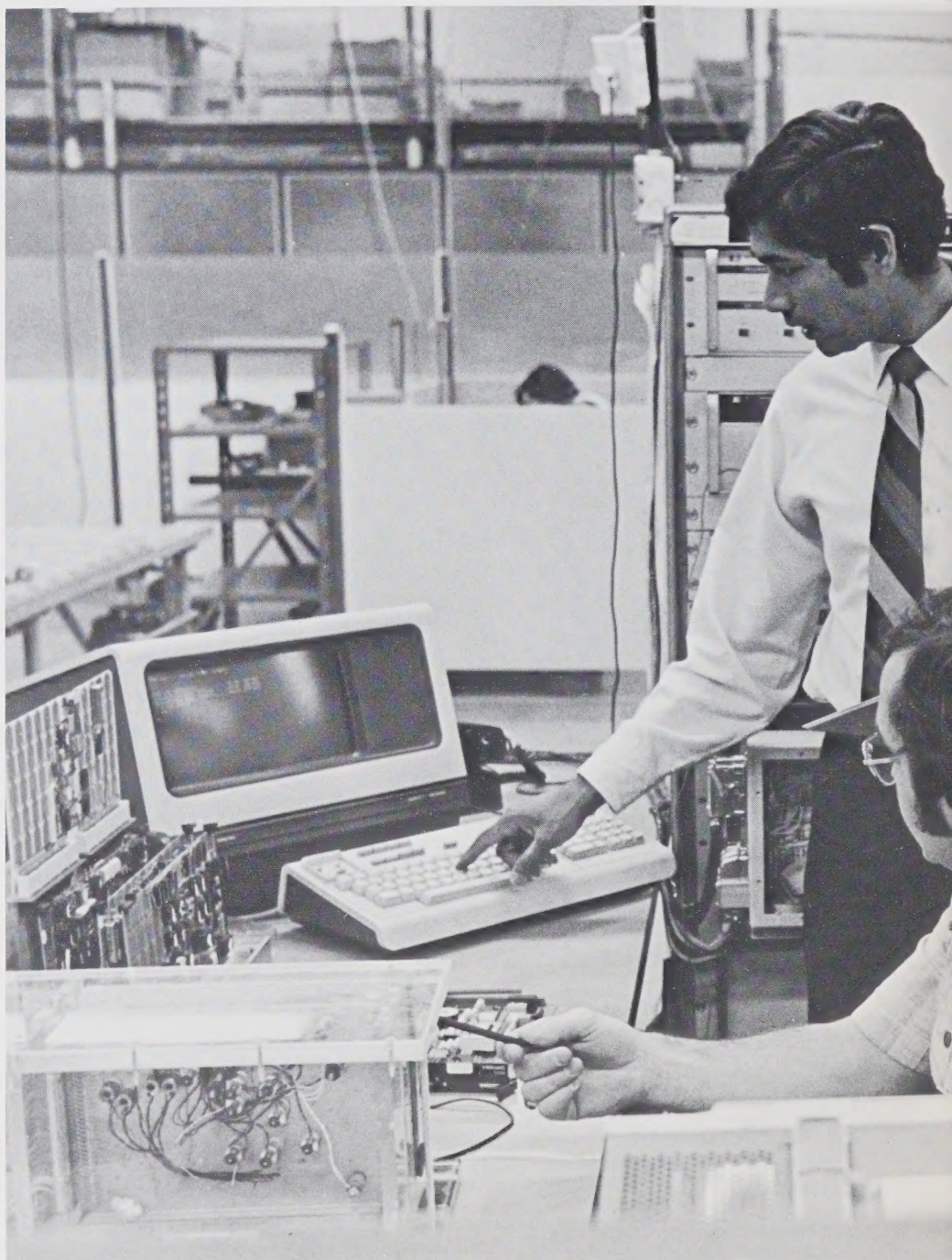
Digital/ tomorrow's technology today

"Digital" is a word you have probably heard recently. It is a word that you will likely be hearing a lot more of in the years to come. The word itself means of or relating to data in the form of numbers or digits. A digital clock or watch, for example, refers to the fact that you read the information directly in the form of numbers.

In the world of telecommunications, digital refers to the way information is transmitted. Interestingly enough, the first form of telecommunications, the telegraph, used a digital method of transmitting information. A message could be translated into a series of "dots" and "dashes" and these electric pulses together with the pauses in between made up a numerical code which could be sent to a distant point where it would then be decoded and translated back into the original message. The drawback, of course, was that the transmission of the message required both the sender and the receiver to be able to translate the message into a digital form and back again. It wasn't the type of system which two people could use if they wanted to simply talk to each other over a long distance.

The invention of the telephone solved this problem. It allowed two people to communicate directly without first translating the message into a code. But this direct speech transmission was not digital. It was analog. Instead of dots and dashes that represented the message, the signals are transmitted in electrical waves that are analogous to sound waves carried through the air. For example, a conventional telephone's transmitter contains carbon granules which vibrate in rhythm with the speaker's voice and send it along the line in the form of a continuous electrical signal. The electrical energy involved increases or decreases according to the loudness or softness of the transmitted signal. One drawback is that as the signal progresses, noise and distortion are picked up. When the signal is amplified so that it may carry over long distances, the noise and distortion are also amplified.

Telephony used analog systems for most of its first hundred years. Scientists talked about adopting digital systems to telephony



Going digital means creating a whole new world of electronic products. New products mean new challenges and new jobs. Automatic testing of the new DE-3 channel unit at Aylmer, Que. requires skilled technicians.



as far back as the 1940s, but the technology available at that time made it impractical. Since then, quantum leaps in computer technology have produced the digital computer and devices called large scale integrated circuits, commercially known as LSI. In making the LSI, thousands of transistors and other electronic devices together with connecting circuits are fabricated on a single piece of silicon crystal called a chip. In essence, the LSI permits an extremely high concentration of electronic circuitry in a very tiny space. Digital circuits use these tiny devices as on-off switches, which in their various combinations of being turned on or off give us the information or message we desire from a computer. They also give us a practical method of applying digital coding to telephony. As one of our young scientists put it:

"The LSI brings to the world of circuitry the same kind of revolution that printing the spoken word brought to the world of communication over 500 years ago.

"The ability to grow and interconnect thousands of transistors on a single chip of silicon, in a process similar to printing, will lead to the widespread distribution and use of enormous electronic circuits, just as printing brought the widespread distribution and use of books.

"It has taken LSI technology relatively little time to mature from a laboratory curiosity in 1972 to very large and practical circuits in 1976. The maturing of LSI has been the last of the needed keys to the production of the practical digital world."

For telephony, digital means being able to convert and transmit voice signals into numerical codes, represented by combinations of impulses, then translating these impulses back into analog or voice signals for the listener at the other end of the system. For the telephone user, we still talk into the phone and hear the other person's voice as usual. Analog and digital sound the same, except for one slight difference. In digital systems, noise and distortion are minimized, and usually eliminated in most cases.

For the telephone companies the advantages are considerable. One inherent advantage is that data as well as voice signals can be transmitted with equal ease over digital telephone networks. Digital systems, in combination with built-in computers, make possible whole new ranges of features and capabilities. Remote switching units, remote maintenance and control, and wide latitude to create and change

operating features, even after a system has been in place and in use, are among the new capabilities.

Going digital means that we can cope with the growing demand for telecommunications services at lower costs. One of the major costs in providing telephone and telecommunications services is the cost of the buildings used to house the central office switching apparatus. Comparable digital systems are considerably smaller than



Excellence of design and manufacture and reliability in use are hallmarks of products wearing the Northern Telecom label. Scientists at Bell-Northern Research constantly test new or proposed products to assure they meet our high standards.

other switching systems required to do the same job. For example, a building which houses old step-by-step switching equipment would have to be five times larger than one which used the new digital switching systems to do the same job. The old crossbar systems would require four times as much space, and even the more modern electronic stored-program-control systems require twice as much space to do the same job. This means a substantial savings in the construction costs for new buildings or additions to older facilities. It means a savings in land and taxes as well.

Digital systems also use energy at a uniform, predictable level. As a result, a digital network is fundamentally simpler and less costly than its analog counterparts, and is inherently more rugged and reliable.



The versatile and innovative SL-1 digital business communications system was introduced in December 1975 and has already become a hot seller in Canada and the U.S. It is manufactured in Belleville, Ont. and at Mountain View, Cal. In addition to manufacturing in the U.S.



and Canada, we have already signed licensing agreements with major world electronics and telecommunications companies in Sweden, England and France for production in Europe.

The advanced microcircuitry which gives Northern Telecom's digital systems their tremendous versatility provides another critical advantage. It offers telephone companies and their customers a built-in hedge against inflation. Costs of micro-electronic components are dropping because of new mass-production techniques and increasing demand.

Digital technology also permits the application of time-division multiplexing, another significant cost-saving feature. This technique allows more than one message to be carried on a single transmission path at the same time. That is, instead of requiring separate sets of wires for each telephone conversation, a large number of conversations can be concentrated onto the same facility. On cable transmission systems, the savings in materials as well as space in underground ducts, are considerable.

As an example of the cost-saving benefits of time-division multiplexing, one DMS-1 system (digital carrier and remote switch, with a capacity of up to 256 subscriber lines) can reduce the amount of cable required to link subscribers with a switching office by as much as 64 to 1. Such a dramatic saving in cable pairs can make single-party service economical for many rural

areas which now depend on party lines. It can also sharply reduce both the time and costs involved in putting lines into new housing developments, apartment buildings, shopping centers and rapidly growing suburban communities.

Modularity is a feature of Northern Telecom's digital switching machines. Major portions of the switching matrix as well as the line or trunk connections are contained in modules, making it easy to enlarge the machines and adapt them to new service requirements. A very large capacity range can be handled by one basic machine. Maintenance, training of central office personnel and stocking of spares are also simplified.

Probably one of the most interesting features about the switch from analog to digital systems is the orderliness of the changeover. It is more evolutionary than revolutionary, and the changeover can take place as fast or as slow as the individual telephone companies wish it to be.

A small digital switching system, for example, can be installed in the corner of a step-by-step office without disrupting existing operations. It can be used to take on new growth or it can be used to take

over from step equipment that is being phased out. In other words, Northern Telecom's digital products are fully compatible with today's analog network.

Northern Telecom digital systems will operate in a pure analog world, a pure digital world, or a hybrid world of analog and digital. This compatibility across the whole range of technological generations lets telephone companies ease their way into the digital world. They are free to start anywhere — transmission, switching, business communications — then expand their digital capabilities according to their own improvement schedules and customer requirements.

Today, most of the telephone company central offices and networks are operating with analog equipment. The analog side of our business will continue to play a large role in our company's future. Not only will we continue to install and upgrade analog systems in many different parts of the world, but our overhaul, repair, and maintenance of existing systems will continue to provide work for thousands of our employees.

But the world of digital is coming, and the demand for digital equipment and digital systems is accelerating, particularly in North America and in Europe. Northern Telecom first entered the digital world when it was still in its infancy in 1965 designing and manufacturing digital carriers. In 1976, Northern Telecom became the first telecommunications manufacturer to publicly commit itself to the development of a complete line of digital products. This announcement effectively made us the one to beat among telecommunications manufacturers around the world who are fighting for shares of the new digital market.

The company intends to introduce the complete family of digital systems between now and 1980, covering every important telephone company requirement in switching, transmission and business communications. The program is being carried out as a joint undertaking of Northern Telecom, Bell Canada and Bell-Northern Research, supported by extensive consultations with other telephone administrations in North America and elsewhere.

Existing members of Northern Telecom's digital family include the LD-1 carrier system, designed for service on trunk routes up to 200 miles long. LD-1 installations have been in operation since 1973 and now cover 65,000 route miles.

For larger applications, the LD-4 digital carrier system is unique in the world for its high capacity. The LD-4 digital coaxial



The digital world is a world of rapid change. Some products have a life expectancy of only a few short years. Keeping competitive in this fast-moving business means investing a large portion of our earnings in research and development. We have invested \$347 millions in R&D in the past 10 years.

cable carrier with repeaters can handle 20,000 simultaneous two-way conversations, or the same number for video or data transmission. The first installation of the LD-4, between Montreal, Ottawa and Toronto, created the world's longest and highest capacity long-haul digital cable transmission system in service.

The LD-1 and LD-4 or their components are manufactured at our Aylmer (Lucerne) plant, the Amos plant, and our cable plant in Lachine.

Northern Telecom produces a variety of Norscreen screened cables for digital carrier transmission systems and an associated development, the DE-3, a versatile digital channel bank introduced in 1976. The DE-3 is being produced at Aylmer. Lachine produces the Norscreen.

Research and development means lots of expensive hardware and equipment as well as new, and more sophisticated testing facilities. But most important, it means finding and utilizing the best minds in the business in our eight BNR labs in Canada and the U.S.

Work is also advancing at our St. Laurent plant near Montreal on the DRS-8 digital microwave system which initially will go into service between Toronto and Sudbury, Ontario. It will provide a digital radio link with the 415-mile-long LD-4 system serving Toronto, Montreal and Ottawa.

In December 1975, Northern Telecom introduced the innovative SL-1 digital business communications system. The control units and the switching matrix are totally digital. In fact, SL-1 established the viability of digital switching in a private automatic branch exchange system in the 100-and-over-line size. It married digital switching with computer software control.

The next phase, now underway, involves the development of digital switching machines for telephone company central offices. The company is designing, and will manufacture, a complete range of digital switching systems to handle anywhere from a few hundred to 100,000 lines. Included are both local and toll systems. To overcome the major problem of transition to

digital equipment faced by many telephone companies, all members of Northern Telecom's digital switching systems family will be compatible with each other and will interconnect with all other systems currently in service.

The versatility and innovativeness of the SL-1 has been recognized in Europe as well as North America where it is exceeding all sales expectations. In Sweden, Televerket, the Swedish government telephone authority has been licensed to manufacture and market the digital PABX system in that country. Similar rights have been licensed to The General Electric Company of England for the U.K.

SL-1's capabilities and capacity are continuously being expanded. In 1976, call detail recording was added to its already broad feature range. In 1977, a remote switching feature will be added. One large telephone company customer with several plants or offices located in different parts of a city can have all its locations served by a single SL-1 system.



The first four nodes (switches) of the Trans-Canada Telephone System's nation-wide Datapac switched digital data network went into trial service in 1976. Datapac uses the SL-10 telecommunications processor to do its switching. SL-10 is a derivative of SL-1, sharing much of the same basic circuitry, again, demonstrating the versatility and adaptability of Northern Telecom's digital family.

Parallel Data-Under-Voice (DUV) systems, developed by Bell-Northern Research, provide economical and reliable digital data transmission, using a normally unused frequency bank on existing analog microwave radio channels. Parallel DUV systems have been in service since 1974.

The SL-1 is currently being produced in our Belleville and Mountain View plants; the SL-10 is produced at Belleville, and the parallel DUV systems are being manufactured in our Aylmer plant.

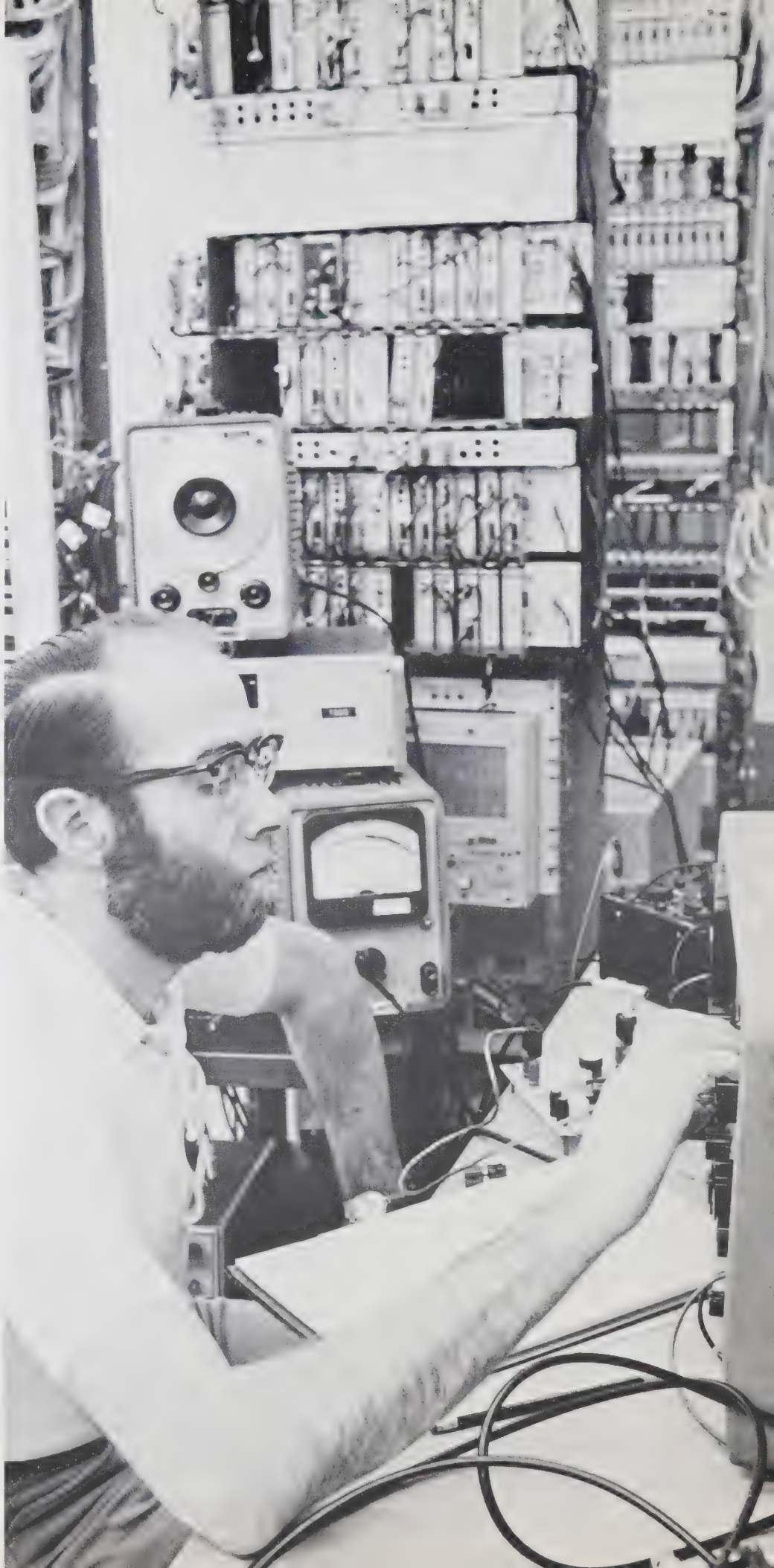
Almost in a class by itself is the DMS-1, a solid state electronic system designed by Bell-Northern Research. The DMS-1, which is produced at our Aylmer plant and began trials in 1976, can play two major roles:

As a "line concentrator" or subscriber concentrator, it can be used to eliminate party lines and upgrade rural service. It enables a relatively small cable, connecting subscribers to a central switching machine, to carry a large number of telephone conversations simultaneously or an existing cable to carry many more. It thereby changes the economics of serving non-urban areas.

DMS-1 also can function as a "remote digital switch". Its remote unit out in the field switches calls between local subscribers on the spot, without the need to route conversations to the switching office and back out again. This results in a potentially higher traffic capacity for the total telephone network, a crucial consideration because of today's rapidly accelerating demands for telecommunications services.

DMS-1 can replace existing community dial offices. In the future, if the system's central switching system is replaced by digital equipment, such as Northern Telecom's DMS-10 or DMS-100, the remote unit can remain in place and function just as if it were part of the central digital exchange.

A lot of our new ideas come to us from the nearly 2,000 scientists, technicians and support people that make up Bell-Northern Research Ltd. Despite its youth—BNR was founded in 1971 and the average age of its employees is 32—it has gained a worldwide reputation for design and innovation. Many of the products it designed and developed are market leaders in North America.



The DMS-10 is yet another diversification of the original SL-1 design while the DMS-100 and DMS-200 are further significant evolutionary developments. A new digital switcher, designated the DMS-10, will be introduced toward the end of 1977 and will serve community dial offices, where requirements range from a few hundred to six thousand lines.

The needs of larger local offices will be met with the DMS-100 digital switching system, scheduled for introduction in 1979. It is designed for applications from 1,500 lines up to 100,000 lines. It will be able to provide Centrex services on a citywide basis.

A full featured toll switching machine, DMS-200, will be introduced the following year (1980) and will have a capacity up to 60,000 trunks. Both DMS-100 and DMS-200 will share virtually the same basic hardware. The main differences will be in their software programs. TOPS, Northern Telecom's revolutionary stored-program-con-

trolled traffic operator position system, will be a feature of DMS-200.

The evolution of the SP-1 family of stored-program-controlled electronic switching systems continues with the development of SP-1E, a configuration that uses the latest LSI technology and a high-density 4K MOS (metal oxide silicon) memory to nearly double the processor call carrying capacity. System capacity, with the large-scale configuration, ranges up to 100,000 lines. More than one million lines, 94,000 toll trunks and 451 TOPS were being switched by SP-1 systems in the United States and Canada today.

A new electronic telephone set has been undergoing field trials since September. Developed by Bell-Northern Research, it incorporates advanced microelectronic devices, condensing all the circuitry normally found in the base of a conventional telephone into the handset. The electronic telephone has been designed to reduce the high maintenance costs of present-day

telephones. Its compact LSI circuits also provide wide latitude to add new features and services.

Research is continuing on fiber optics transmission systems which are expected to go into service on large metropolitan trunk spans during the 1980s. Northern Telecom's fiber optics systems will be digital and fully compatible with Northern Telecom's digital family.

For over a decade, digital equipment has been taking over more and more functions. However, to date, this invasion has been on a piecemeal basis.

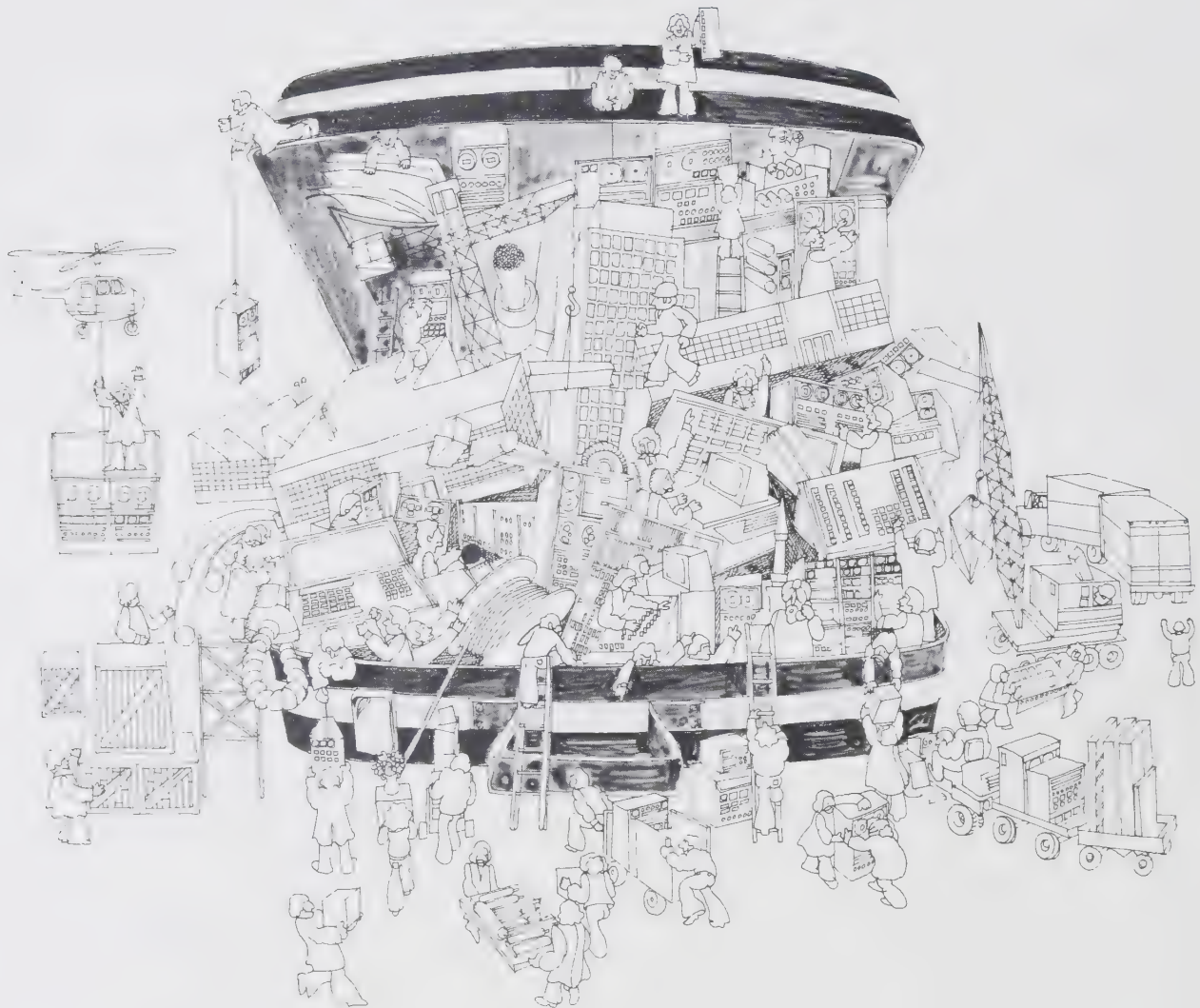
Now, Northern Telecom is bringing all the benefits of digital technology together in a totally integrated development program. It is designed to produce systems that will stand on their own in today's analog world, provide a wide range of new services for the consumer, and help control and reduce operating company costs as the telecommunications industry moves further into the digital world.



Digital will mean not only better service and money-saving advantages for customers and the telephone companies, it will also provide a whole new range of services and advantages. At Aylmer, Que. we are producing the versatile DMS-1 solid-state digital switching system which can be used to eliminate party lines and upgrade service in many rural areas. The DMS-1 can also be used to replace existing community dial offices and functions as a remote digital switch.



Where it's at at Northern Telecom



Northern Telecom is a large company. It has grown rapidly over the past five years. During that time sales doubled. Manufacturing operations were started in the United States, Eire and Malaysia. New plants were built in Quebec, western Canada and the Atlantic provinces

The company's name was changed from Northern Electric to Northern Telecom Companies were acquired and others created in Canada, Europe and Asia

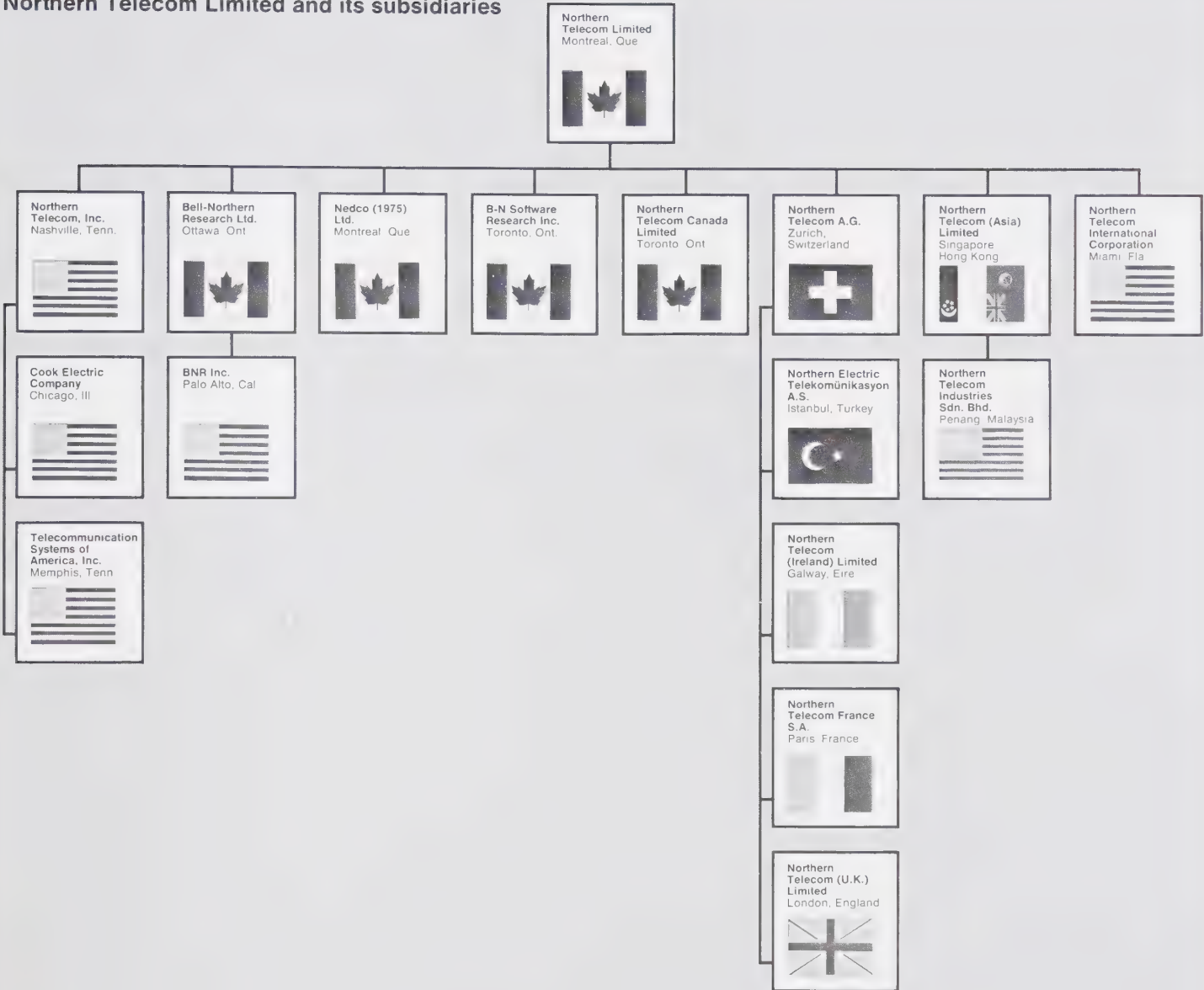
Where once everyone knew the location of every plant and who was managing it, nowadays it is difficult for us as individuals to keep up with the changing score card as new companies, new divisions and new plants are added.

On the next 6 pages are a series of charts designed to bring you up to date. The one facing, on page 13, shows how the company is organized around the world and how each subsidiary relates to every other and to Northern Telecom Limited, the parent company.

In the next chart are listed all the plants in each country and the products or services for which each plant is responsible.

The last series of charts show the way in which the major North American companies are structured. By following the organization charts you can see how the management chain flows from the factories of the operating subsidiaries in the U.S. and Canada, all the way to chairman of the board of the parent company.

Northern Telecom Limited and its subsidiaries



Northern Telecom manufacturing facilities

Canada



Switching

Brampton, Ont.

Digital, electronic and electro-mechanical switching systems, relays

Calgary, Alta.

Electronic switching equipment, cable forming

*Charlottetown, P.E.I.

Central office fuses

Lachine, Que.

Relays

LaSalle, Que.

Power equipment, test sets

LaSalle, Que.

Step-by-step switching systems, connectors, multiple cables

Montreal, Que.

Sheet-metal and piece parts, machines and tools

St. John's, Newfoundland

Networks and sensors

Winnipeg, Man.

Cable forming and dry-reed relays

Subscriber Equipment

Amherst, N.S.

Residential and business telephones and components

Belleville, Ont.

Electronic and digital PABXs, components and key telephone systems

London, Ont.

Residential and business telephone sets and components

Regina, Sask.

Telephone sets and buzzers

Saint John, N.B.

Cables for PABXs and connector cables

Cable

*Amherst, N.S.

Telephone cable

Calgary, Alta.

Telephone cable and building wire

Kingston, Ont.

Telephone cable and enamel wire

Lachine, Que.

Communication and power cables

Regina, Sask.

Telephone cable

Transmission

Aylmer, Que.

Digital transmission equipment

Lachine, Que.

Printed circuit packs and device testing

St. Laurent, Que.

Multiplex, voice frequency and radio equipment, capacitors

Winnipeg, Man.

VF cables, cable forms and components

Repair and Overhaul

Calgary, Alta.

Repair and overhaul of telephone sets

Montreal North, Que.

Repair and overhaul of telephone sets, test sets, teletypewriters and electronic equipment

North York (Toronto), Ont.

Repair and overhaul of telephone sets, test sets and teletypewriters, electronic equipment

Saint John, N.B.

Repair and overhaul of telephone sets, test sets and teletypewriters

Outside Plant

Lachine, Que.

Backboards, apparatus cases, connectors, loading devices, protectors, terminals and closures.

Winnipeg, Man.

Protectors

*new plant being established

United States



Adelanto, Cal.

Repair and overhaul of telephone sets

Creedmoor, N.C.

Electronic and digital switching systems

Concord, N.H.

Voice frequency and test equipment

Kevil, Ky.

Repair and overhaul of telephone sets

Leesburg, Fla.

Repair and overhaul of telephone sets

Medina, N.Y.

Repair and overhaul of telephone sets

Morton Grove, Ill.

Outside plant equipment, toll data collection systems, loop treatment and voice frequency equipment and tape transports

Mountain View, Cal.

Electronic and digital PABXs

Nashville, Tenn.

Telephone sets and distribution center

Tampa, Fla.

Repair and overhaul of telephone sets

Texarkana, Tex.

Repair and overhaul of telephone sets

West Palm Beach, Fla.

Printed circuit boards, printed circuit packs and telephone set components

Eire



Galway

Telephone sets, PABX components, and voice frequency equipment

Brazil



Rio de Janeiro

Outside plant equipment — protectors

Turkey



Istanbul

Electromechanical switching systems, switchboards and telephone apparatus.

Malaysia



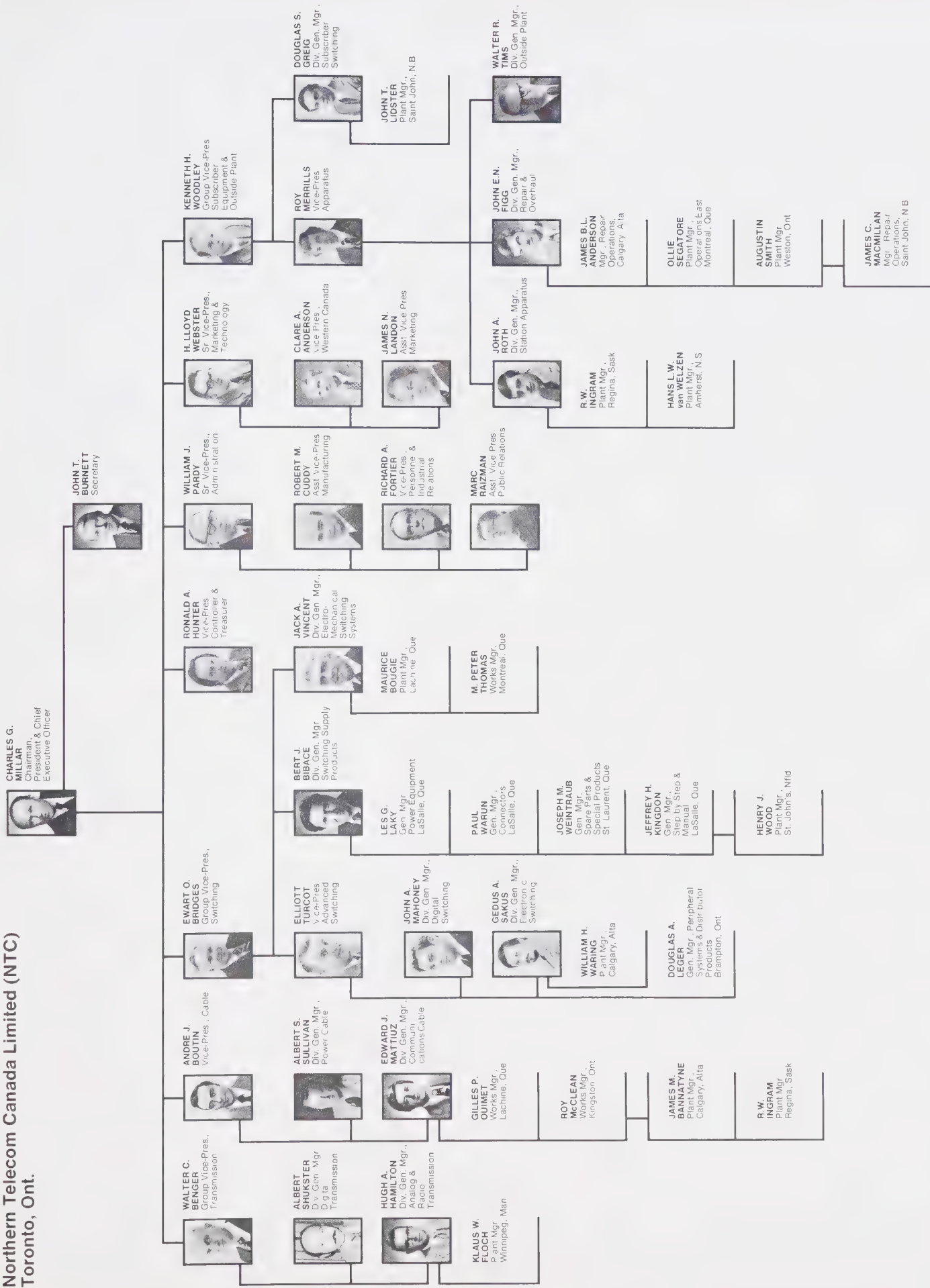
Penang

Heat coils, cable forms, capacitors, switchboard lamps and telephone set components

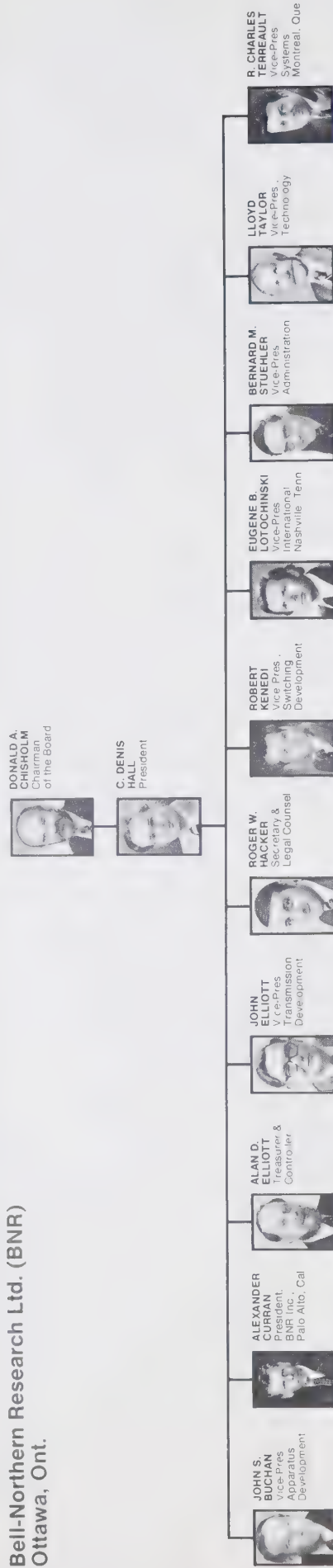
ROBERT C. SCRIVENER
Chairman of the
Board & Chief
Executive Officer



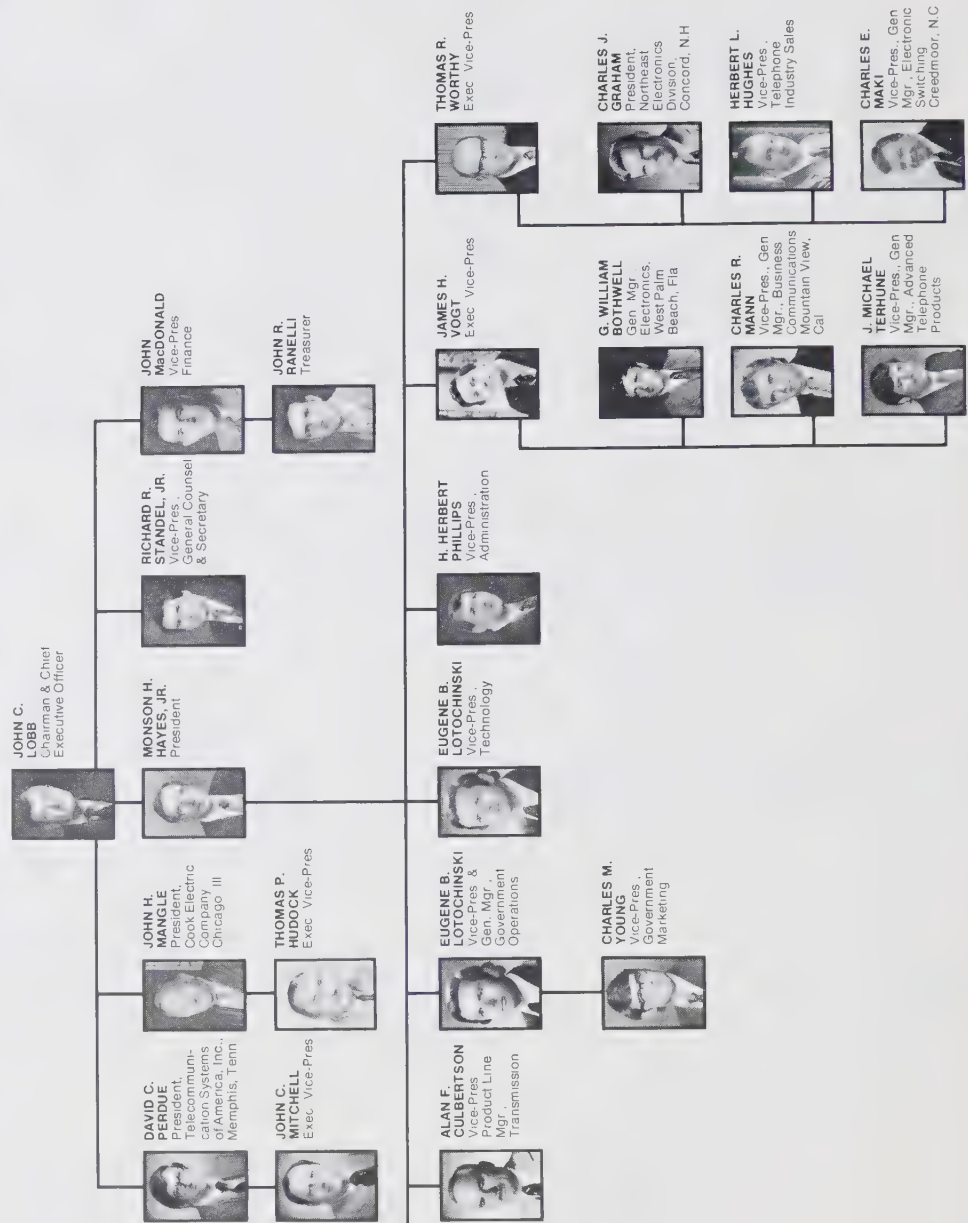
Northern Telecom Canada Limited (NTC) Toronto, Ont.



Bell-Northern Research Ltd. (BNR) Ottawa, Ont.



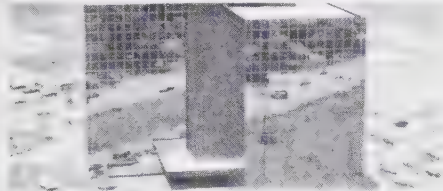
Northern Telecom, Inc. (NTI) Nashville, Tenn.



Serving the U.S. market

Since its incorporation in late 1971, Northern Telecom, Inc., our U.S. subsidiary, has grown from a simple distributor of products imported from the factories of the parent company to a significant U.S. manufacturer of telecommunications equipment. Today its 12 plants — which include those of Cook Electric Company, acquired last December — reach from coast to coast and have 2,940 employees. They produce transmission, switching, subscriber, outside plant and test equipment, and provide repair and overhaul service for telephones and telecommunications equipment. These plants are supported by an R&D organization at Palo Alto, Cal. devoted to the development of new products for the U.S. and world markets.

International Plaza, Nashville, Tenn.,
headquarters for Northern Telecom, Inc.



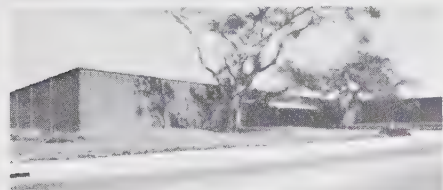
Kevil, Ky



Morton Grove, Ill



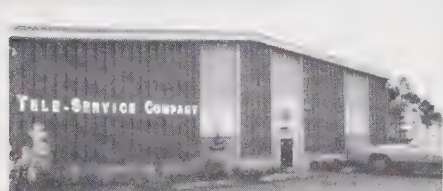
Mountain View, Cal.



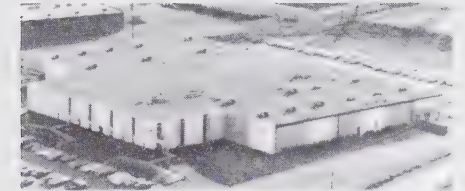
Adelanto, Cal.



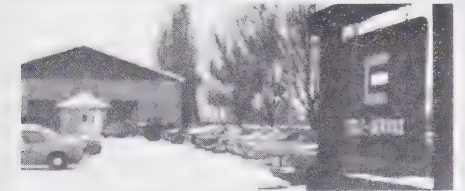
Texarkana, Tex.



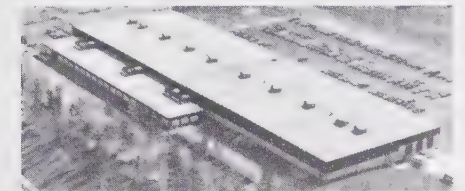
Nashville, Tenn.



Medina, N Y



Creedmoor, N.C.



Concord, N.H.



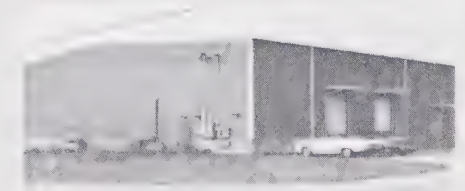
West Palm Beach, Fla.



Leesburg, Fla.



Tampa, Fla.



Winning a bigger share of the world's largest telecom market

by John C. Lobb

**Chairman and
Chief Executive Officer
Northern Telecom, Inc.**

The past year was an eventful one and saw many developments important to our future growth in the United States.

Northern Telecom, Inc. ended 1976 larger and stronger than the previous year. Equally significant, it ended the year with the organizational structure in place to develop important new markets for our products.

In December an especially positive note was sounded when Cook Electric Company and Telecommunication Systems of America, Inc., joined the Northern Telecom family of companies.

Cook and TSA each bring to our United States operations new capabilities which will improve our ability to serve two important markets. In the case of Cook this is primarily the telephone industry market. With TSA we gain broad experience in the market for private telecommunications systems.

Other milestones of 1976 include completion of the move of the corporate offices to Nashville; establishment of the Nashville plant as a growing division of the company; expansion at Creedmoor, N.C. and Mountain View, Cal.; increased capacity at West Palm Beach, Fla.; development of new products and new capabilities at Northeast Electronics, Concord, N.H.; the preparation for production of the DMS-10 digital switching systems at Creedmoor and introduction of the SL-1 business communications system to both the independent telephone company and private systems markets.

At Palo Alto, Cal., an associated company, BNR Inc., began to expand its capability to assist NTI with research and development activities. Among its projects in 1976 were development of hotel/motel features for the Pulse EPABX and completion of a project for the U.S. Army at Fort Monmouth, N.J.

The U.S. independent telephone market — currently operating 27 million telephones — presently is our primary market in the United States. But in addition to the telephone companies, there are two other very large markets and one new market which are attracting our attention in increasing amounts. First, there is the government and military market. Hundreds of millions of dollars per year are spent on telecommunications systems by organizations within this group. To penetrate this market, we have established a new division called government operations.

Another important market in the U.S. for telecommunications equipment is the rapidly growing private systems market. Unlike Canada, it is legal in the U.S. for private businesses and institutions to own their

belief that the customer is the best judge of whether owning a system, or leasing it from the local telephone company, most suits his individual business. We will sell our equipment through either channel, but experience is showing that an increasing number of companies are opting to buy — and many of these select our Pulse and SL-1 EPABXs as the systems they want.

To help us sell in the private systems market we purchased TSA, with facilities in four other locations in the south-central United States. TSA has a proven track record of selling, installing, and servicing sophisticated telecommunications systems and has a major contract for installations at oil production facilities in the North Sea. TSA has installed over 30,000 telephones, serving over 400 customers, including banks, hospitals, newspapers, major corporations, and insurance companies.

TSA was a pioneer in adapting telecommunications systems with computer technology for financial controls, pricing and maintaining detailed information systems. The TSA people will combine their special talents with our own experts to market such products as the SL-1 to the private systems market and to adapt these systems to the



special needs of our customers. The existing NTI office at Fort Lee, N.J., outside New York City is now part of TSA and plans are being formulated for additional sales/service offices in other major metropolitan areas.

Retail selling of telephone equipment primarily for residential use is also a rapidly growing market in the U.S. It's another brand new market for us, but we think it's going to be an important one. So, we've set up a new division to handle the marketing of our products to retail outlets.

But our biggest customers are still the telephone companies, which have been our mainstay since we first established our presence in the U.S. more than six years ago. Our established products like the SP-1, manufactured at Creedmoor and the SL-1, produced in Mountain View continue to sell well.

In June, 1975, Northern Telecom competed with major international telecommunications manufacturers in Europe, Japan, and the U.S. to win a master agreement to provide central office switching systems for the Puerto Rico Telephone Company. Deliveries and cutovers under the contract have been on time or ahead of schedule

ever since and demonstrate our ability to design, manufacture, install and place in service major telephone facilities. Total value of this contract over six years will be over \$150 million.

An SP-1 training switch was installed by February 1976 and the first central office was cut over four months later in June 1976. To date five SP-1 central offices totalling 29,800 lines have been cut over to switching equipment manufactured at our Creedmoor plant. We are currently installing another 5,400 trunks and 198 TOPS positions; two central offices totalling 11,200 lines and two extensions totalling a further 17,600 lines. Orders on hand include a toll center of 1,888 lines and 57 TOPS positions and five other central offices, totalling 41,000 lines. Additional orders from the Puerto Rico Communications Authority for central office switching equipment and a 10,000 line extension are in the works.

In addition to all this the Puerto Rico Telephone Company has purchased more than \$1.2 million worth of our Contempra telephones and Centurion coin telephones. All this adds up to a good deal of new business for our plants in Nashville, West Palm

Beach and Creedmoor which turn out the products and components we are selling to Puerto Rico.

In addition to increasing sales of our digital electronic private automatic branch exchange, the SL-1, we have begun marketing other digital products as well. The Commonwealth Telephone Company of Dallas, Pennsylvania, signed the first letter of intent to purchase a DMS-10 digital central office switching system and the first installation of such a system will take place at North Florida Telephone Company, Live Oak, Fla.

We also improved our overall capacity to serve the telephone market by entering the important outside plant and the overhaul and repair businesses in the U.S. by purchasing the Cook Electric Co. headquartered in Morton Grove, Ill. The company has served the telephone industry for more than seventy years and has facilities in St. James (near Winnipeg, Manitoba); Kevil, Kentucky; Leesburg, Fla.; Texarkana, Texas; Medina, N.Y.; and Adelanto, Cal.; and a subsidiary in Brazil. Cook's Tele-Service Company subsidiary is one of the largest independent repair and overhaul contractors in the U.S. and Cook's protection equipment is widely used and respected by major telephone companies.

All in all it was a busy year for us in the U.S. and we expect a busier one ahead. The growth we have been experiencing has meant the creation of many new jobs and the addition of hundreds of new employees. By the end of 1976, the number of employees working for Northern Telecom, Inc. had increased to 1,878. With the addition of Cook and TSA at the end of the year, we gained an additional 1,100 employees bringing the total to nearly 3,000 at the start of 1977.

This rapid growth has meant a tremendous strain on our human resources to train new personnel and assimilate new organizations into the company. Managers, supervisors and production workers have all made great strides in achieving this while also adjusting to the new processes required as new products are introduced.

The progress made in 1976 represents personal contributions by each NTI employee and a willingness to accept change — which is the price of growth, especially in the electronics business. It is the kind of positive work attitude that will allow us to continue the successes of the past far into the future.



CAN CANADIANS MATCH WITS WITH THE WORLD... AND WIN?

YES. By anticipating future telecommunications needs and trends and matching them with specially conceived and designed Northern Telecom products. And we have been doing that successfully for a number of years now.

The key to this success is Bell-Northern Research Limited, Canada's largest industrial research organization. The 1,800 BNR employees include 1,100 scientists, engineers, industrial designers and others with special technical or professional qualifications. Their collective resources and talents make BNR one of the world's most respected telecommunications research establishments.

The products that have come from these laboratories have provided Canadians with one of the finest telephone systems in the world. They have also proven themselves technologically superior in the United States and Europe. They have provided the base and springboard for Northern Telecom's thrust into markets around the world.

SP-1 electronic stored-program-controlled central office switching systems outsell all competitive systems in North America, outside the U.S. Bell System.

Pulse* electronic private automatic branch exchanges (EPABX) are also market leaders in Canada and in the independent telephone company market in the U.S.

The Contempra* residential telephone set and the Logic* business telephone sets have established international standards for design and efficiency.

The LD-4 high-capacity coaxial cable designed to provide circuits for over 20,000 simultaneous two-way telephone conversations provides Canada with the world's longest commercial digital cable transmission system.

The newest product from the BNR labs, already receiving international recognition, is the SL-1 digital EPABX. This small, incredibly flexible and versatile machine can meet the diverse switching needs of a modern high-rise office building, thus replacing the multiplicity of private switchboards and exchanges usually found in such a building.

Can Canadians match wits with the world and win?

The Canadian-designed products we're producing in factories in Canada, the United States, Europe and Asia are the daily proof they can... and are.

*Trademark of Northern Telecom Limited.



NORTHERN TELECOM LIMITED, MONTREAL, QUEBEC

THE NEW NAME IN WORLD TELECOMMUNICATIONS.

Manufacturing plants and sales offices throughout Canada and the United States, also in London, England; Paris, France; Amsterdam, The Netherlands; Zurich, Switzerland; Galway and Dublin, Eire; Hong Kong; Singapore; Penang, Malaysia and Istanbul, Turkey.
Prior to March 1st 1976, Northern Telecom Limited was known as Northern Electric Company, Limited.

Future and challenge in Canada are greater than ever

by Charles G. Millar

**Chairman, President and
Chief Executive Officer
Northern Telecom Canada Limited**

Our drive for a larger share of world markets sometimes tends to obscure our opportunities in Canada.

Canada is still our major market. It is our home base, and will always be a major market for our products and services.

We have been supplying the telecommunications needs of Canadians since 1882 and take pride in the fact that Canadian telephone and telecommunications systems and products rank among the finest in the world. An increasing demand for more service and for new systems to meet new communications needs will continue to mean new opportunities and new challenges for us in Canada.

We are No. 1 in Canada. We supply more telecommunications equipment and services to Canadians in all 10 provinces than any of our major competitors.

Our size is important to us and to Canada. It has enabled us to concentrate the manpower, the expertise and the experience needed to market leading products of the most sophisticated technology and to enter international markets on an equal footing with multinational companies from the U.S., Japan and Europe. Our size also gives us the ability to provide our Canadian markets with superior products at prices which are more than competitive with these same multinationals.

Success in all our markets—Canada, the U.S., Europe, Asia and South America—is critical to our research and development efforts. Our Canadian market just isn't large enough to absorb the high research and development expenses necessary if we are to continue our technological leadership. We need the international markets to provide additional sales to support our current levels of research and development.

We spend, by far, the most money on industrial R&D of any company in Canada. We maintain the country's largest R&D organization. Last year, we spent \$61.5 million on R&D, or 6.5 cents of every sales dollar. To put it another way, Northern Telecom invested \$2,433 for each of its 25,277 employees around the world for development of new products, which ensure future sales and future jobs.

Our international operations are important to us here in Canada in another way. Developing manufacturing plants in Turkey, U.S. and Eire also increases business for our Canadian plants. Many of the products

our foreign subsidiaries produce are assembled from components made in and exported from our Canadian plants. In some countries, where it is difficult for us to market our products because of trade restrictions, it is necessary for us to establish licensing agreements and/or local subsidiaries to penetrate these markets. The sale of a Canadian-designed Contempra telephone assembled in Ireland from Canadian components and sold to telephone companies in England, France, or West Germany, gives us a vital foothold in these markets and the opportunity to sell other products created and designed by Canadians.

Northern Telecom's international activities have created jobs for 2,200 Canadians, which are included in our total of 17,200 Canadian employees. There are currently 1,200 Canadian jobs directly attributable to our U.S. operations and an additional 1,000 Canadian jobs to activities in other parts of the world.

This year—1977—we have entered a new phase in Canada. Canadian operating management has been separated from corporate management and our Canadian operations have been constituted as a new company, Northern Telecom Canada Ltd.

For most of our employees the creation of the new company has entailed no change. There are no changes in union contracts, work assignments, reporting lines, products, working conditions, pensions, benefits, health plans, or other activities. However, some managers have been



presented with new assignments and new challenges as the organization was restructured. On page 17 there is an organization chart which shows the channels of communication and responsibility from the plant level through to the president of Northern Telecom Canada.

As with our other operating companies in the U.S., Europe and Asia, NTC is responsible for manufacturing and marketing activities in its own geographic area.

NTC is one of Canada's major companies. It ranks among the top 30 in sales, and has 25 plants for a total of 5.2 million square feet of manufacturing space.

We serve all aspects of the Canadian telecommunications market. In addition to our traditional markets in Ontario and Quebec, we continue to increase our sales in western Canada and the Atlantic provinces. Over the past four years we have invested \$11.4 million in 11 new plants to create hundreds of new jobs and millions in new payroll and tax revenues in these regions. These plants and our other new and expanded facilities in Quebec and expanded plants in Ontario provide the base from which we will continue to serve Canada's growing telecommunications needs.

Our size, our position in the market and our financial strength ensure ample opportunities for personal growth in all areas of our manufacturing, installation, marketing and sales. Our four major product groups of cable, transmission, switching, and subscriber equipment present ample opportunity

for rotation of assignments and development of personal expertise in diverse businesses.

Our senior management people thus develop a broader perspective of business opportunities than is common in most organizations. Our cable group in future years will continue to concentrate on two main areas of production: communications cable and power cable. The subscriber equipment group will concentrate on manufacture and sale of outside plant, station apparatus and subscriber switching products and will be responsible for our repair and overhaul operations.

Recent growth can be seen in our switching group. In addition to our digital, electronic, and electromechanical switching systems divisions, we have established four subdivisions in our switching supply products division: connector product line, power equipment, spare parts and special products, and step-by-step and manual. These products generate more than \$300 million in annual sales. Our transmission group operates an analog and transmission division and a digital division from which we supply a broad spectrum of microwave radio, repeaters, subscriber carrier and other transmission products.

It is the team effort from each of these specialized areas, producing our full range of products, which allows us to compete across the broad spectrum of the telecommunications market.

We have earned our present market position in Canada by virtue of superior prod-

ucts and attractive prices. In short, we compete. We have historically competed in Canada with all the major telecommunications multinationals in the world. There are 29 subsidiaries of foreign multinationals and 13 Canadian firms presently competing with us for business in Canada.

This competition will not lessen, it will increase. This means we will have to continue to match the eight percent annual productivity gains we have achieved in recent years, so that we can continue to produce equipment of the highest quality and reliability at the most competitive prices.

I expect that our ongoing programs of capital investment and improved manufacturing methods will continue to provide us with products manufactured at the lowest cost and in the most efficient manner possible.

Canadian telecommunications markets are expected in the future to continue to grow at about the eight percent level of recent years. Past capital construction expenditures of telephone companies are the best indicators of future growth.

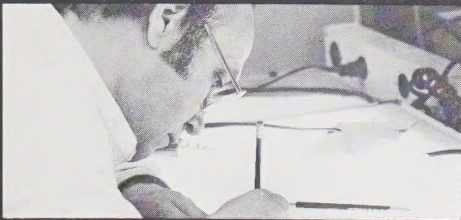
In Canada, capital construction expenditures grew from \$706 million in 1970 to an estimated \$1.9 billion in 1976. Expenditures in western Canada more than tripled over the period; while the Atlantic Provinces were slightly below this rate of growth, Bell Canada more than doubled. Industry forecasts indicate capital expenditures in Canada to be \$2.1 billion for 1977; of this amount approximately 55 percent will be for telecommunications products.

We have the products, the resources and the people. Our future depends on the personal drive and determination of all of us to continue to provide Canada with superior products at competitive prices.

Knowing intimately the quality and capability of our people I have no doubt that Northern Telecom Canada will continue to build and add to its proud history of outstanding accomplishments.



Charles Millar compares notes on plant operations with NETAS production manager, Burhan Canbel (right) in the expanded NETAS factory in Istanbul, Turkey.



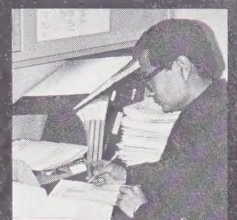
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Amherst, N.S.



Toronto, Ont.



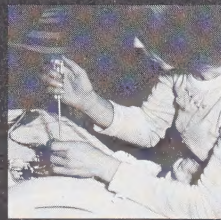
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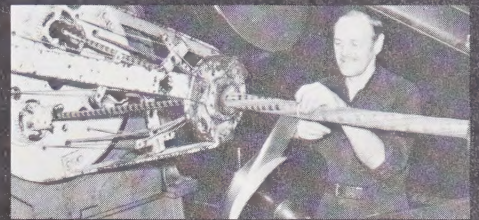
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Regina, Sask.



Leesburg, Fla.



Lachine, Que.



Lachine, Que.



Texarkana, Tex.



LaSalle, Que.



London, Ont.



Palo Alto, Cal.



Morton Grove, Ill.



Calgary, Alta.



St. John's, Nfld.



St. Laurent, Que.



Penang, Malaysia



Saint John, N.B.



Mountain View, Cal.



Montreal North, Que.



St. Laurent, Que.



London, Ont.



Galway, Eire



Texarkana, Tex.



Lachine, Que.



London, Ont.



Nashville, Tenn.



Galway, Eire



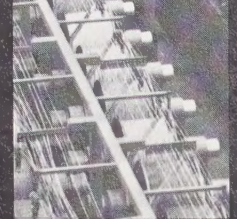
Kingston, Ont.



Kevil, Ky.



Istanbul, Turkey



Kingston, Ont.

